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AUTHOR Mathis, David
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ABSTRACT

A study examined the use of the accelerated reader (AR) computer program to increase the reading comprehension scores on the Stanford Achievement Test (SAT) of sixth-grade students compared to the previous year when they did not use the program. The study reviewed results and methods from previous research regarding use of the AR program. Subjects for the study were 30 sixth-grade students from a rural farm community in north central Illinois. Raw scores of reading comprehension from the SAT administered each spring for each of the subjects were recorded from their fourth-, fifth-, and sixth-grade test results. The pretest and posttest group design was used to ascertain if there was a significant net gain in reading comprehension from the fifth-grade test (pretest) to the sixth-grade results (posttest) with the use of the AR program, as opposed to the raw scores of the fourth-grade (pretest) and fifth-grade posttest without the AR program. Results indicated that, after a year of exposure to the AR program, there was no statistically significant increase in reading comprehension scores from the fifth to the sixth grade. (Contains 3 tables of data and 12 references.) (CR)

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THE EFFECT OF THE ACCELERATED READER PROGRAM ON READING COMPREHENSION

David Mathis

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Reading has long been considered one of the most important skills that a child needs to learn. The ability to pick up a book and comprehend what has been read is a necessity which will enable a child to learn information on his or her own. For these reasons schools wish to employ the best method of reading instruction available.

Although a number of studies have looked at the value of basal approach and whole language to teach reading, a new approach has emerged. The use of computer to teach reading is the latest way to develop these skills. This is such a new approach, few research projects have been done on the topic. It seems most of the programs to date can be categorized by two groupings. One is programs that have the student read a passage and answer a number of multiple choice questions about it. An example of this type of program is the Home Run Reading Program. A second type is a combination of literature based reading and using a computer based testing program to measure student reading practice. An example of this program is the Accelerated Reader program.

This study will focus on the use of the Accelerated Reader (AR) program to boost reading skills in sixth graders. The instrument to be used to measure this is the Stanford Achievement Test Series in reading comprehension.

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Any battery of tests that has survived to an eighth edition, as has the Stanford Achievement Test Series (SAT), must have some satisfied customers. It is a professionally crafted product that provides a variety of useful and understandable information to students, administrators, parents and teachers.

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The content of each subtest was selected to provide "representative and balanced coverage of a national type curriculum" (Kramer & Conoley, 1992). SAT covers most of the concepts and skills most commonly taught in U.S. schools.

Content. All items on the eighth edition are new; none have appeared in earlier editions. The item tryout sample, (n = 215,000) was a representation of the nation in terms of school district size, geographic area, and socioeconomic status. In all, 1000 schools participated. The overall quality of the individual items appear very good.

Scores and Norms. Performance of the students is described by percentile ranks, stanines, scaled scores, normal curve, grade equivalents, raw scores, and ability comparisons. Even though their intention was good, there may be more information than most people would want to try to comprehend.

Normative data are available by grade level, fall or spring administration, and test form. The norms are based on large samples (total n = 300,000) that are representative of U.S. schools in terms of geographic region, socioeconomic status, urban/rural location, and ethnicity. Three problems arise from the score reporting. The inclusion of ability achievement comparison is problematic, because these scores are easily misinterpreted, have well-known statistical deficiencies and are often misused. It would be nice if the percentage of students would fall into each ability range (high/average/low).

Second, there isn't an explanation of the "skill groupings" in any manual and material accompanying the test. Skill grouping is also misinterpreted and misused. Third, there isn't enough warning that all scores contain some measurement of error and shouldn't be considered to be precise indicators.

Validity. A major shortcoming of the series is the lack of convincing arguments and data in support of the validity of the battery. Their own report of validity is less than one page. This report suggests there is evidence of content validity by comparing the test items to local assessment and points out that manual testing the instructional objectives underlying the test item (Illinois Goal Assessment Plan of Illinois) will be useful in

making this determination. However, it gives no further suggestion as to how such a study should be done. Furthermore, no evidence is presented to show the subtest has content validity in terms of their stated goal of representing national consensus curriculum or the IGAP (Kramer & Conoley, 1992).

The SAT reading test should be considered a good achievement test, but not a diagnostic test. For general screening purposes, the comprehension subtest could be used for such purposes as Chapter 1 identification, but they would need to follow with more precise testing. The results of the test could also be used for the grouping of students by reading ability. However, it fails as a device to determine where school weakness might be or as an instrument to provide the necessary information to plan a good reading program (Mitchell, 1985).

If children score high, one might reasonably assume they comprehend the material well. If they score low, they probably don't comprehend very well. This last interpretation may be misleading.

The low score may be misleading because of a number of factors. Reading tests do not control for a student's desire to read. How much students get out of their reading depends a great deal on their motivation to read. Going along with motivation is how seriously the student took the test, whether the student had a good breakfast, or potential problems the student may have had at home or school. Any of these could keep him/her from concentrating on the test.

Another factor that affects lower reading comprehension scores is that the reading test passages are usually unmotivating and even boring. Most people find that their comprehension of material they are interested in is substantially higher than their comprehension of material that bores them. For many, even a test setting is not enough incentive to pay attention to material that doesn't make any connection with issues relevant to their lives. A good reader can overcome this and still perform well on the test, but a lower level reader won't (Sternberg, 1991).

One of the objectives of standardized tests is to create a controlled environment so that differences in performance can be attributed to differences in behavior being tested. In standard testing, the environment is presumed to be controlled by using exactly the same tasks and by administering and scoring in exactly the same way. Research studies have demonstrated this objective is at best a naive one. Factors such as test taking knowledge (Scruggs, White & Bennion, 1985), student attitude toward tests (Paris, Lawton, Turner & Roth, 1991), gender (Miles & Middleton, 1990), and race (Natriello, McDill & Pallas, 1990) all appear to have an impact on standardized test performance.

Accelerated Reader

The Accelerated Reader (AR) computerized reading management program is the most widely used program of its type in the country. Introduced in 1986 by Advantage Learning Systems, over one million students in over eight thousand schools nationwide are using the program. The AR computer program is a tool that helps teachers efficiently manage a literature based reading program. It saves the educator's time and eliminates the need for book reports. It also has several unique features that motivate students to read.

The program is based on a simple three step process. First a student selects a book to read from the AR book list. Each book on the list has a point value based on grade level and number of words using the Fry Readability Index (Fry, 1968). The Fry Index considers the number of syllables in words and sentence complexity. Below is the AR formula to calculate the point value of a book using reading level and number of words.

$$\text{AR points} = \frac{(10 + \text{Reading Level}) \times \text{Words in Book}}{100{,}000}$$

Second, the student reads the book he/she has chosen. Third, the student goes to the computer and takes a test on the book read. The computer scores the test, calculates

how many points the student has earned and records the score. There is extensive documentation on the AR's effectiveness in getting students to read.

The AR program was involved in a research study asking the question, "Does reading practice cause reading growth?" Subjects for the study were 4,498 school students from 64 different schools. The collected data can be classified as a one group pretest posttest design. Thirteen different pieces of data were collected for each student. The following table describes each piece of data.

Table 1 Description of Data Elements

Data	Description
School Number	A unique integer indicating the school that the student attended
ZIP Code	The student's school's ZIP code
State	The student's school's state
Test Number	An integer representing the standardized test used for the student's test scores
Student Number	An integer (1 to 64) and a letter (A to Z) to encode the student's data location on the data sheets
Birthdate	The student's date of birth
Grade	The student's grade at the time of the posttest
Teacher	An integer representing the teacher within a given school
Pretest Score	The grade level reading score before the start of the reading program
Date of Pretest	
Posttest Score	The grade level reading score after the end of the reading program
Date of Posttest	
Accelerated Reader Points Earned	The number of points earned from participation in the Accelerated Reader reading program between the pretest and posttest

Several derived values were created for each student. The first was age in years at the time of the pretest. The integer portion of this value was considered to be the age

A second derived value was called deviation score, which was calculated by using this formula: Deviation Score = (Pretest Score + 5) - Age.

This equation yielded a score that suggested the amount by which a student's ability deviated from normal age adjusted reading ability. If the student was reading at his/her grade level, the deviation would be 0. Students reading above their grade level would have positive deviation scores and students reading below grade level would have a negative deviation score.

A second, simpler derived score was called reading growth. It was figured by subtracting the pretest from the posttest score. The last necessary correction came from increasing the maximum reading level of 12.9 to 13.8 on the standardized tests. This was done by calculating the standard deviation and median for reading ability by age.

The theory of reading practice predicts that reading practice causes different rates of reading growth depending on reading ability and age shown below. The mean, standard deviation, and minimum and maximum values were determined for each cell for pretest/posttest, Accelerated Reader points earned, reading growth, age, and deviation. The statistics were also calculated for each quartile by using AR points. The results clearly validate the theory of reading practice and there is an increase in reading growth for students participating in the AR literature based program. Shown below are the statistics for each cell.

Table 1 Populations, Mean Ages, and Mean Deviations

		Reading Ability		
		Low	Average	High
Age	Grade 4 and younger (8 to 9 years)	Cell: 1 Students: 247 Mean Age: 8.55 Mean Dev: -1.25	Cell: 2 Students: 936 Mean Age: 8.05 Mean Dev: 0.67	Cell: 3 Students: 369 Mean Age: 8.22 Mean Dev: 3.79
	Grades 5 and 6 (10 and 11 years)	Cell: 4 Students: 437 Mean Age: 10.60 Mean Dev: -1.80	Cell: 5 Students: 960 Mean Age: 10.55 Mean Dev: 0.59	Cell: 6 Students: 565 Mean Age: 10.47 Mean Dev: 3.84
	Grades 7, 8, and 9 (12 years and older)	Cell: 7 Students: 443 Mean Age: 12.59 Mean Dev: -2.48	Cell: 8 Students: 740 Mean Age: 12.35 Mean Dev: 0.47	Cell: 9 Students: 699 Mean Age: 12.53 Mean Dev: 4.36

Correlation statistics (r) for the least squares regression of points versus reading growth are significant at 1% level in 6 of 9 cells. For these groups, reading practice shows dramatic growth in reading ability. The slopes of the linear equation derived from the least squares regressions also provide support that incremental amounts of practice will cause more reading growth in poor readers than in good readers. Slopes also decline as one moves down the matrix. This also is consistent with the theory that young readers grow more from reading practice than more mature ones (Terrance, 1992). The table shown below exhibits all of these factors.

Table 3 Reading Ability, Growth, Points, and Regression Statistics

		Reading Ability		
		Low	Average	High
Age	Grade 4 and younger (8 to 9 years)	Cell 1 Students: 247 Beginning Reading Ability: 2.31 Growth: 1.25 Points: 34 Regression Statistics Slope: 0.0235 Intercept: 0.9551 r: 0.1389	Cell 2 Students: 936 Beginning Reading Ability: 3.62 Growth: 1.47 Points: 24 Regression Statistics Slope: 0.0303 Intercept: 1.2209 r: 0.2269	Cell 3 Students: 569 Beginning Reading Ability: 7.02 Growth: 1.27 Points: 57 Regression Statistics Slope: 0.0048 Intercept: 0.9807 r: 0.0419
	Grades 5 and 6 (10 and 11 years)	Cell 4 Students: 437 Beginning Reading Ability: 3.02 Growth: 1.25 Points: 23 Regression Statistics Slope: 0.0314 Intercept: 0.9833 r: 0.2563	Cell 5 Students: 861 Beginning Reading Ability: 6.29 Growth: 1.41 Points: 47 Regression Statistics Slope: 0.0037* Intercept: 1...479 r: 0.0519	Cell 6 Students: 565 Beginning Reading Ability: 9.66 Growth: 1.83 Points: 92 Regression Statistics Slope: 0.0083 Intercept: 1.0720 r: 0.0887
	Grades 7, 8, and 9 (12 years and older)	Cell 7 Students: 643 Beginning Reading Ability: 5.01 Growth: 1.62 Points: 24 Regression Statistics Slope: 0.0379 Intercept: 1.0854 r: 0.2327	Cell 8 Students: 341 Beginning Reading Ability: 7.83 Growth: 1.36 Points: 40 Regression Statistics Slope: 0.0027 Intercept: 1.2705 r: 0.0708	Cell 9 Students: 955 Beginning Reading Ability: 11.05 Growth: 0.54 Points: 64 Regression Statistics Slope: 0.0010 Intercept: 0.4706 r: 0.0360

Another study was done on the effects of the computerized AR program on reading achievement. The objective of the study was to see if AR significantly improved reading skills of middle school students. Subjects were college prep freshmen from two

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junior high schools (50 students). There was no difference between the two groups regarding demographics or basic curriculum. Total CAT (Children Assistance Trust) reading scores were utilized for this study and scores were taken from third, sixth, and eighth grade cumulative records and compared.

Results indicate that the group using computerized reading system had a mean gain of CAT reading scores over a 5 year period. The school that used the AR program had mean scores of 726, 780, and 797 on their CAT tests. The group that didn't use the AR program had mean scores of 736, 767, and 775 for the same time span on their CAT test (Peak & Dewall, 1992).

Does the use of Accelerated Reader cause an increase in the reading comprehension scores on the SAT of sixth grade students compared to the previous year in which they did not use the program?

The population consisted of 37 sixth grade students from a rural farm community in LaSalle county which is located in north central Illinois. The town is Grand Ridge with a population of 600 and the school is a K-8 building with 348 students with 2 classes for each grade level. The school district consists of one school and covers an area 110 square miles. 74% of the students ride a bus to school.

The ethnic background of the total enrollment is 93.9% White; 2.3% Black; 1.8% Hispanic; 1.8% Asian; .3% Native American. Students coming from low income families are 18.7 %.

Thirty sixth grade students were chosen from 37 students. The basis for this decision was that seven of the students had incomplete test scores in their files or they moved into the district and had taken tests other than the Stanford in their fourth or fifth grade years. The range of age of these students was 11 years 8 months to 12 years 7 months.

METHOD OF DATA COLLECTING

Each spring the Stanford Achievement Test Series is administered to the students attending Grand Ridge School District. Raw scores of reading comprehension of the sixth graders were recorded from their 4th, 5th, and 6th grade test results. The pretest and posttest group design will be used in this study to see if there is a significant net gain in reading comprehension from the fifth grade test (pretest) to the sixth grade results (posttest) with the use of the AR program, as opposed to raw scores of the fourth grade (pretest) and fifth grade posttest without the AR program.

The Stanford Achievement Test, 1982 edition; Level Intermediate 3, Form J was used. The Kuder Richardson 20 reliability coefficient is presented for each test and subtest of the total reading score. The three grade level KR 20 reliability coefficients fall within .83 to .92 with a median of .90 for the national sample on the reading comprehension part of the test.

The findings will be tabulated in terms of mean and standard deviation. The t test will be employed at the .05 level of confidence to determine if there is any statistically significant difference between the mean scores.

FINDINGS OF THE STUDY

A t test ($p < .05$) for independent samples was done on these four sets of tests. This was done to see if there was a statistically significant change in reading comprehension net gain scores from fifth grade to sixth grade after being exposed to the AR program during their sixth grade year.

Reading Comprehension

Test	Before Accelerated Reader	
Pretest M_x= -.27 SD_x= 5.98	(net gain 5th grade -- 4th grade score)	N_x= 30
	After Accelerated Reader	
Posttest M_y= -.53 SD_y= 7.50	(net gain 6th grade -- 5th grade score)	N_y= 30

After one year of being exposed to the Accelerated Reading program there is no statistically significant increase in reading comprehension scores from the fifth grade to the sixth grade. Over all the data leads to the acceptance of the null hypothesis. There will not be a significant increase in reading comprehension after being exposed to the AR program.

DISCUSSION OF THE STUDY

There are three main areas that might explain why students didn't show an improvement. The first is looking into the area of why the students didn't show an improvement in their reading comprehension. In looking at the books read by the students for the AR program, I noted that a lot of the books chosen by the students are below grade level. This would seem to have no impact on increasing their comprehension. In one of the studies covered in the review of literature, students were given no credit for reading books below grade level. Second, the attitude and motivation of the students on the day of the test might have an impact on their comprehension scores. How seriously did some of these kids take the Stanford tests? They were given 40 minutes to do this section and some were done in 10 minutes. A closer monitoring would need to be done here. The third area deals with achievement tests themselves. Are the passages interesting and are they a true measure of a student's performance? Hopefully, it isn't the only standard used to measure a student's reading comprehension.

FUTURE DIRECTION

There are three main areas in which the work could be extended. In what areas are the poor comprehension students deficient? One study suggests that they have the following problems:

1. Making inference and integrating information from different parts of a text.
2. Understanding pronouns and other anaphoric expression and monitoring comprehension of this.
3. Working memory skills and specific aspects of text comprehension (Oakhill, 1993).

Once students have been identified, maybe there could be skills and drills developed, along with the AR program to improve their reading comprehension.

Secondly, a correlation study could be done on the number of points accumulated on the AR program by individual students versus their reading comprehension on SAT. A third study could be done comparing the type of memory skills needed to take an AR test and achievement test. Memory for AR testing is long term memory. If students are reading books, they probably take a number of days to read the book and then take a test on it. The reading achievement test is immediate recall. Students read a passage and answer questions about it. This would be short term memory. Trying to compare performance of long term memory vs. short term may be hard because the retrieval processes are different.

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